Interconnection: Legal, Procedural, and Economic Issues

Workshop on Interconnecting Distributed Energy

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Overview

- Integrating customer-owned, customer-sited DG facilities into the utility grid depends on the ability of consumers to purchase, install, and interconnect this equipment easily.
- Three sets of issues need to be addressed:
  - Metering arrangements, which determine energy value
  - Technical requirements for interconnection (safety and power quality issues); and
  - Non-technical requirements for interconnection (legal, procedural, and economic issues).

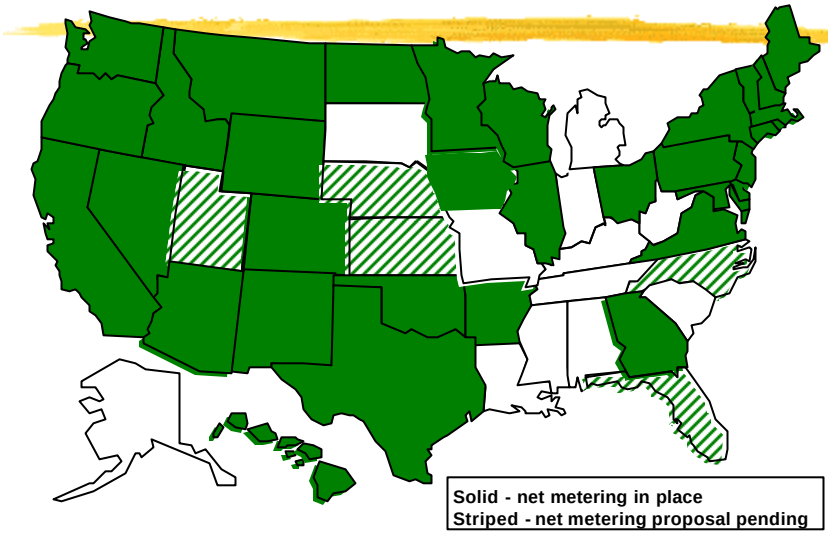
Metering Issues

- Metering policies determine the value we place on the energy that flows through an electric meter.
- Metering policies can be used to encourage renewable energy investments by increasing the effective rate of return; or they can be used to penalize such investments.
- 34 states (including Hawaii) now require net metering for certain small-scale renewable energy systems, with proposals in other states and in the U.S. Congress.
- Other metering options enable the establishment of 'green pricing' programs that pay a premium for 'green' resources

What Is Net Metering?

- Allows customers to use excess renewable generation to offset utility-purchased electricity on a periodic basis (usually a monthly or annual period);
- Effectively values all renewable generation (up to parity) at retail rates; any excess generation is sold at the lower 'avoided cost' rate, or is uncompensated;
- Most electricity meters used in residential and small commercial applications are bi-directional, making net metering easy to implement without meter replacement.

Net Metering



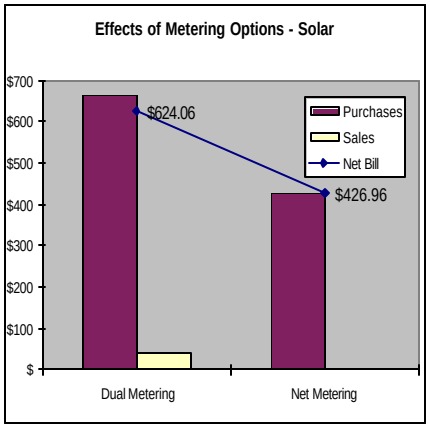
Benefits and Costs of Net Metering

- Benefits:
  - Encourages direct customer investment in small-scale renewable energy systems;
  - Simplifies interconnection by avoiding meter replacement;
  - Improves economics of small-scale renewables;
  - Reduces metering and administrative costs for utility.
- Costs:
  - Exacerbates the revenue loss from self-generation
  - Makes tracking of customer's energy flows difficult (unless a dual-register meter or dual meters are used)

Effects on Utility Bill w/ Solar PV

Assumptions:

- 20 kWp solar PV System
- PV system generates ~ 2600 kWh/month
- Business uses 5000 kWh/month
- Retail price is $0.18/kWh
- "Avoided cost" price is $0.03/kWh
- PV-to-load ratio is 0.50



Making Net Metering Viable

- Use of program 'cap' and other size and technology constraints to limit scope of program to a level that is manageable for utilities;
- Avoid excessive standby charges and other fees, which can offset the economic benefits of net metering;
- Pro-actively address issues of net metering implementation in retail access environment.

Net Metering: The Bigger Picture

- MidAmerican's legal challenges:
  - Iowa District Court held that Iowa net metering rule is preempted, but Utilities Board and other parties promptly appeal.
  - FERC rejected MidAmerican's argument in a companion case, upholds the Utilities Board's adoption of net metering.
  - **A settlement of these cases has been proposed!**
- Momentum is increasing for national net metering:
  - Appears to be bipartisan support in both Senate and House for net metering and uniform interconnection standards
  - National legislation would make the legal challenges moot and would be the quickest and simplest way to resolve jurisdictional conflicts -- and to get net metering in all fifty states.

Beyond Net Metering

- Some utilities and energy service providers are paying a premium for 'green' electricity delivered to the utility network by customer-owned, utility-interconnected renewable generating facilities
- New metering technologies make the more sophisticated metering necessary for these 'green pricing' programs available at a reasonable cost
- It is important to pro-actively address issues of net metering implementation in retail access environment.

Beyond Net Metering

- "Green" premiums (incentive rate programs, green tag purchases, feed laws?)
- Bi-directional "real time pricing" allowing customers to capture the real-time price for the electricity they deliver back to the utility grid -- now available in California.
- New metering technologies make the more sophisticated metering necessary for these programs available at a reasonable cost

Interconnection: Technical Issues

- The Problem:
  - Utilities are responsible for maintaining the safety and reliability of the grid, and have legitimate concerns about the interconnection of equipment to the network.
  - BUT, utilities face a conflict of interest because they have an incentive to discourage self-generation by customers.
- The Solution:
  - Uniform adherence to codes and standards developed by nationally-recognized independent authorities, such as IEEE, UL, and NEC.

Standards Are Being Developed

- Standards have been finalized for PV technology:
  - NEC Article 690 addresses wiring and installation of PV systems
  - IEEE 929-2000 addresses utility interconnection of PV systems
  - UL 1741 addresses performance and testing requirements for static inverters and charge controllers used in PV systems
- Standards are being developed through IEEE SCC21 (now IEEE 1547) for other distributed technologies, including wind turbines, fuel cells, gas turbines, and energy storage

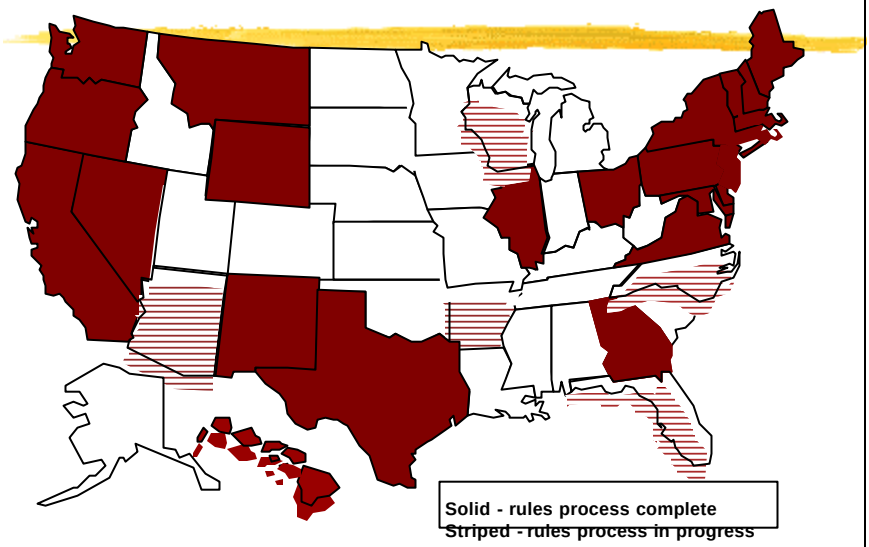
Standards Must Be Adopted

- **The development of standards does not ensure their adoption by regulators and/or utilities**
- Utilities historically have had the discretion to reject or modify standards, defeating the purpose of standardization
- Failure to adopt uniform standards perpetuates problems: Customers, equipment manufacturers, and utilities are all disadvantaged.

Technical Standards Adoption

- Seventeen states have adopted interconnection standards based on UL/IEEE
- These states are: CA, DE, GA, HI, MD, MT, NJ, NM, NV, NY, OH, OR, RI, VT, VA, WA, WY
- A number of additional states are addressing technical interconnection standards for small- and large-scale systems
- States have started addressing interconnection standards outside of the net metering context -- important for DG facilities that are not eligible for net metering

Adoption of Technical Standards



Adoption Is *Not* Implementation

- Streamlining interconnection involves three essential steps:
- Development of standards => DONE!
- Adoption of standards => IN PROGRESS . . .
- Implementation of standards => STILL TO COME . . .
- Example -- California: Implementation required nearly five years, and involved the repeated intervention of the legislature, the PUC, the utilities, the CEC, CalSEIA and other stakeholders

Standards for Larger Facilities

- Most simplified interconnection requirements have been adopted in conjunction with state net metering laws
- Many net metering laws limit eligibility to systems as small as 10 kW - 25 kW
- This means larger-scale facilities are still subject to more traditional, more burdensome requirements
- These larger systems are an increasingly important part of the renewables market because of 'green pricing' programs
- Streamlined interconnection of larger systems is getting a big boost from efforts to develop standardized interconnection requirements for a broader array of distributed technologies (e.g. DE, NY, TX, CA)

Expanding Adoption Efforts

- The good news: the "templates" are in place
- The bad news: lots of work remains to be done!
- Many states have net metering but have not adopted national technical standards
- Many states have adopted standards for small-scale PV (and perhaps other inverter-based systems) but have not adopted simplified standards for other systems
- Proposals for national technical standards are beginning to surface -- may well be part of national restructuring

Interconnection: Non-Technical Issues

- Customers seeking to interconnect a 20 kW PV or wind energy system are frequently subject to the same contracting requirements as the developers of 500 MW cogeneration facilities
- There will NEVER be a mass market for customer-sited renewables if consumers need an attorney and a consulting engineer to negotiate contracts with utilities
- The cost of negotiating and establishing interconnection needs to be commensurate with the size and type of generating facility
- Regulators and legislators recently have started recognizing the need for simplified, standardized contracts for small facilities

Questions of Scale

- A 2 MW fuel cell operating as baseload generates about 1.5 million kWh per month, worth approximately $75,000 per month assuming energy costs of $0.05 per kWh
- A 20 kW solar photovoltaic system generates ~ 2,600 kWh per month, worth approximately $400 per month assuming it retail offset at $0.15 per kWh
- Which can afford $4,000 in interconnection costs?
- Which can afford $100/kW-yr in standby/backup charges?
- "Plug-and-Play"-type treatment is essential for successful commercialization of micro-scale generating facilities

Interconnection Agreements

- Regulators and legislators recently have started recognizing the need for simplified, standardized contracts for small facilities
- ASES Policy Statement on Interconnection includes model PV interconnection agreements
- MSRI has developed two model PV interconnection agreements: up to 15 kW, and 15-100 kW
- Conectiv (Delaware) has developed simplified agreements for all DG technologies, up to 25 kW and up to 1 MW

Insurance Requirements

- Number of states prohibiting additional insurance requirements for net metered facilities: 8 (CA, GA, HI, MD, NV, OH, OR, and WA)
- Number of states limiting the amount of liability insurance coverage that can be required for net metered facilities: 5 (ID, NM, NY, VA, VT)
- Texas rule on DG interconnection provided for mutual indemnification and limitation of liability, but the PUC rejected additional insurance requirements

Interconnection Studies

- Another issue that is emerging in the context of DG rules is the requirement that customers pay for interconnection studies to determine the effect (if any) of the DG facility on the utility distribution system.
- These interconnection studies can be expensive, and could create a substantial additional barrier for small RE systems.
- EX: In New York, DG systems over 15 kW will pay a $350 application fee, plus the cost of a "coordinated interconnection review," plus the cost of any equipment the utility concludes from the review is necessary to provide additional protection for its system, plus an annual payment of 10% of the cost of the equipment as an O&M charge.

Fees & Charges for Interconnection and Operation

- Fees and charges should be commensurate with the size and scale of the generating facility, but they are not.
- In some cases, fees may completely wipe out energy savings associated with a DG facility.
- Fees include:
  - Interconnection-related fees
  - Additional operating charges (fixed or variable), including additional metering charges and 'standby' charges
  - Competitive transition charges that discourage self-generation

Applicability of Fees and Charges

- Most net metering laws prohibit additional fees and charges, such as interconnection fees and backup or standby charges
- But facilities not eligible for net metering are often subject to these additional fees and charges -- e.g. CA
- States are now starting to address these issues in the context of developing standardized interconnection requirements for DR resources. These rules will shape the future market for grid-tied DG facilities, other than those systems eligible for net metering

Effect of Fees and Charges

- From NREL's Making Connections Report:
- Pennsylvania consumer wins free 300-Watt "SunSine" PV system!
- System will produce approximately 400 kWh per year, worth about $40 per year
- Utility imposes a $100 "application fee" for interconnection, plus a "processing/inspection fee" of up to $300
- These fees combined completely offset approximately 10 years worth of anticipated energy savings!

Restructuring and Ratemaking

- Potential shift to covering distribution costs through fixed charges rather than usage-based charges significantly reduces incentives for customer-sited DG investments
  - EX1: $5 fixed plus 10 cents/kWh: 600 kWh => $65 bill; Same customer reduces energy use to 300 kWh => $35 bill
  - EX2: $23 fixed cost plus 7 cents/kWh: 600 kWh => $65 bill; Same customer reduces energy use to 300 kWh => $44 bill
- In this example, benefits of installing small-scale DG system are cut from $30 to 21, about a 30% reduction in effective energy savings

Resolving the Revenue Dilemma

- Short run: Agree on a level of market penetration for DG that can be accommodated without significant technical or economic concerns, and allow this level of penetration without economic penalty.
- In the long run:
- (1) Develop and implement ratemaking principles that compensate the utility based on something other than energy 'throughput'; and
- (2) Allow utilities to make the distribution investments necessary to enable a distributed energy future, funded by ratepayers who benefit from increased reliability.

Conclusions

- Technical requirements for interconnection need to be uniform.
- Costs of interconnection need to be minimized.
- Interconnection agreements need to be simplified.
- Fees and charges for interconnection and operation need to be commensurate with the size and complexity of the generating facility.